



NASA STTR 2008 Phase I Solicitation

T9 Technologies for Human and Robotic Space Exploration Propulsion Design and Manufacturing

Achieving the Space Exploration Goals that NASA has defined will hinge on continued development of improved capabilities in propulsion system design and manufacturing techniques. NASA is interested in innovative design and manufacturing technologies that enable sustained and affordable human and robotic exploration of the Moon, Mars, and solar system. Implementing certain aspects of the NASA Vision for Space Exploration will require versatile, reliable space propulsion engines that can operate over a wide range of thrust levels, high specific impulse, and have multiple restart capability. The development of and operation of these propulsion systems will benefit greatly from improvements in design and analysis tools and from improvements in manufacturing capabilities.

Subtopics

T9.01 Technologies for Human & Robotic Space Exploration Propulsion Design and Manufacturing

Lead Center: MSFC

This subtopic solicits partnerships between academic institutions and small businesses in the following specific areas of interest: Innovative design and analysis techniques, manufacturing, materials, and processes relevant to propulsion systems launch vehicles, crew exploration vehicles, and lunar orbiters and landers. Improvements are sought for increasing safety and reliability and reducing cost and weight of systems and components.

- Polymer Matrix Composites (PMCs) Large-scale manufacturing; innovative automated processes (e.g., fiber placement); advanced non-autoclave curing; damage-tolerant, repairable, and self-healing technologies; advanced materials and manufacturing processes for both cryogenic and high-temperature applications.
- Ceramic Matrix Composite (CMCs) and Ablatives CMC materials and processes are projected to significantly increase safety and reduce costs simultaneously while decreasing system weight for space transportation propulsion.
- Solid-state and friction stir welding, which target aluminum alloys, especially those applicable to high-performance aluminum-lithium alloys and aluminum metal-matrix composites, and high strength and high temperature or functionally graded materials.
- New advanced superalloys that resist hydrogen embrittlement and are compatible with high-pressure oxygen; innovative thermal-spray or cold-spray coating processes that substantially improve material properties, combine dissimilar materials, application of dense deposits of refractory metals and metal carbides, and coating on nonmetallic composite materials.
- Advanced NDE Methods Portable and lightweight NDE tools provide characterization of polymer, ceramic and metal-matrix composites, areas include, but are not limited to, microwaves, millimeter waves, infrared, laser ultrasonics, laser shearography, terahertz, and radiography.

-
- Improvement in techniques for predicting the self-generated dynamics of space propulsion system when operated at off-design conditions.
 - Improvement in techniques for predicting the acoustic field produced by the operation of a space propulsion system in near ground operation.
 - Predictive capability of the performance and environment for systems, solid or liquid propellants, undergoing multi-phase combustion.
 - Improvements in prediction of stability and stability margins for liquid, gaseous, and solid propulsion systems.
 - Zero net positive suction pressure pump design and analysis techniques.
 - Design and analysis tools that accurately model small valves and turbopumps.
 - Data bases and instrumentation advances required for validation of previously mentioned predictive capabilities.